chiefly on the hypogastric nerves. Their experiments further showed that the vessels of the uterus obtain their nerves from the same sources as the muscular tissue, the nervi hypogastrici supplying the constricting and the sacral nerves the dilating fibres, which can likewise be brought into action reflectorially through the sciatics.—*Lancet*, Nov. 16, 1878.

MATERIA MEDICA AND THERAPEUTICS.

The Action of Arsenic.

The action of arsenic is a subject for investigation of much importance. Its therapeutic value is so well established as to render it one of the most reliable agents we possess for effecting certain objects. Indications are not wanting that the range of its therapeutical employment may be considerably extended, and there is reason to hope that a more accurate study of its physiological action may render its use more precise in those diseases in which it sometimes does good, but more often fails.

A series of papers have been lately published in *Virchow's Archiv*, which contain an account of an elaborate research into some particulars of its action by Dr. A. LESSER, of Berlin. The first point investigated is its action on the heart of the frog. It is known that the effect of a large dose of arsenic is to retard the action of the heart, and to finally arrest it in diastole. Although the frog lives on for some ten minutes, no stimulus will reawaken the cardiac contraction, even though the heart is excised. Sklarek found nevertheless that the irritability of the muscular tissue of the heart persists, and hence he concluded that the arsenic acts by paralyzing the motor ganglia of the heart. Lesser has observed that the form of the cardiac contraction is changed by the arsenic; the contraction of the ventricle becomes irregular, so that it undergoes peculiar changes of form during its systole. The interval between the contraction of the auricles and of the ventricles becomes unequal, and ultimately that of the auricles ceases long before that of the ventricles. Almost to the last a slight touch on the auricle at the opening of the sinus will provoke a local contraction, and a stronger stimulation one of the whole heart. Hence Lesser infers that the ganglia of Remak lose their irritability before the ganglia of Bidder. This conclusion was in part corroborated by a further series of observations on the isolated ganglia regions, which showed further that the paralysis of the ganglia of Remak is preceded by a transient increase in their irritability, the result of which is, if the heart is separated from the central nervous system, to cause an initial increase in the frequency of its contractions. When its central connections are undisturbed, this increase is not observed, in consequence of the arsenic causing a simultaneous stimulation of the vagus, by which the effect on the ganglia is counteracted. An increase in the frequency of the heart's action has been noted in man as an effect of small doses o arsenic; but doubt has been raised whether it is not of merely psychical origin. This increased frequency of the pulse was, however, found by Lesser to be a constant effect in warm-blooded animals of the intravenous injection of small doses, and he found further that the acceleration is not accompanied by any noteworthy increase in the arterial blood-pressure. Medium doses cause first an increase, and then a decrease in the heart's action, while large doses decrease it from the first. In the latter case the pressure in the aortic system falls immediately, and the more rapidly the larger the dose. If arsenic is injected subcutaneously the increased frequency of the pulse is a regular though very brief consequence, but otherwise the phenomena agree perfectly with those which follow the injection of arsenic into a vein. The increased frequency of the pulse is found to be the result of two conditions—a diminution of the tonic action of the vagus, and an augmentation of the action of the cardiac ganglia. The diminution in the frequency of the heart's action which is produced by larger doses is due to a depression of the action of the cardiac ganglia, and in some cases an increase in the tonic action of the vagus. In some animals, as in the frog, it was found that the muscular tissue of the heart does not lose its irritability. That of the ends of the vagus in the heart, tested by the electrical stimulation of the trunk of the vagus, is first increased by the action of the arsenic, then is lowered, and finally extinguished. On the other hand, the action of the accelerator nerves of the heart is in no way affected by the arsenic. Nor can any effect be ordinarily traced upon the centre for the vaso-motor nerves, upon those nerves themselves, or upon the muscular tissue of the vessels. For the stimulation of the vaso-motor centre an amount of arsenic is necessary which cannot reach it when the arsenic is injected into a vein; it is necessary to inject it directly into the carotid artery. Even then, however, stimulation of the centre is the only effect; paralysis can never be obtained.

A very marked effect on the adjacent respiratory centre was also observed to be produced by arsenic. It appears to be due in part to the direct action of arsenic upon the centre, and in part to the stimulation by it of the ends of the vagus in the lungs. The direct effect upon the centre is demonstrated by the fact that it is to be observed even after section of the trunks of the vagi; and the effect on the pneumogastric in the lungs is proved by the fact that when these nerves are intact the effect on the respiration is greater than when they are divided. Larger quantities of arsenic extinguish the irritability of the respiratory centre, but less rapidly when the vagi are intact than when they have been previously divided. The initial increase in the respiration is not very great, for the respiratory movements, although increased in frequency, are diminished in extent. A very interesting experiment corroborates the direct action of arsenic upon the centre. A certain strength of the induced current applied to the central end of the right vagus of a rabbit produced constantly a certain acceleration of respiration, never an arrest. Some minutes after the subcutaneous injection of fifteen milligrammes of arsenic per kilogramme of weight of the animal, precisely the same stimulation of the vagus caused an arrest of the respiratory movements, due to tetanus of the inspiratory muscles. Forty minutes later, when the second stage of poisoning had set in, the same mode of stimulation with a much stronger current failed to produce the effect. If the same quantity of arsenious acid is brought into relation with the nerve-centres more rapidly than by the method of subcutaneous injection, the effect is more intense, and of a paralyzing rather than a stimulating character. The diminished action of the respiratory centre occurs immediately after the introduction of the arsenic. The objection may, however, be raised to these experiments that the disturbance of respiration is possibly the consequence of changes in the gaseous contents of the blood, resulting from the retardation of the heart's action and of the movement of the blood. But if the carotid on one side and the jugular on the other be opened immediately after the effects of the poisoning by arsenic are manifest, it will be seen that there is still a marked difference in the colour of the arterial and venous blood; and this, in conjunction with the fact that the heart continues to act strongly for some minutes after the respiratory movements have ceased—as evidenced by a needle through the wall of the thorax, or a manometer introduced into the carotid artery, seems effectually to meet the objection. Hence, although arsenic certainly kills coldblooded animals by its action on the heart, it does not, as Sklarek thought, kill warm-blooded animals in the same way, the heart being in them the *ultimum moriens.*

The effect upon the temperature was carefully observed in these experiments. It was found to present a remarkable depression, proportioned in degree to the duration of the intoxication. In one experiment, which lasted 230 minutes, the fall was from 38.7° to 28.9° Centigrade; in another, lasting 130 minutes, it was from 38.5° to 31.2°; and in a third, lasting 52 minutes, from 39.9° to 36.3°. The fall was more rapid in the first half of the poisoning than in the second. The amount of the arsenic administered had little influence on the rapidity or degree of the depression.

The action of arsenic on the intestinal canal is of considerable importance, on account of the special effect which is produced on these organs in acute poisoning. Peristaltic action is increased, and even a tetanic contraction of certain parts of the intestinal wall, in consequence of the irritation of the ganglia contained in the wall; for either or both of these phenomena may be produced by the local action upon isolated portions of the intestine. The effect occurs immediately after the injection of the poison, and long before any influence on the heart or respiration is produced, and cannot, therefore, be ascribed to the diminution in the amount of oxygen in the blood. Neither section of the vagus nor of the splanchnic nerves has any influence on the result.

Besides this effect on the muscular coat, gastro-enteritis is, as is well known, a constant phenomenon of poisoning by arsenic. Böhm and Unterberger asserted that on this account arsenic is more poisonous when administered by the mouth than when injected into a vein; that the smallest fatal dose by the mouth is not fatal if injected. Lesser is unable to confirm this conclusion. He found it most lethal by injection, as are most poisons. The croupous membrane, which is often present in the stomach and small intestine, was only found when arsenic in the form of powder was given, never when a solution was employed. The false membrane always contains large quantities of crystals of arsenic, whereas they are few or absent in that part of the mucous membrane which is the seat of a simple catarrhal inflammation. Doubt has been thrown by recent observers upon the old opinion that arsenic in the blood is excreted by the intestinal mucous membrane, but this view is confirmed by Lesser, who has found that an appreciable quantity can be extracted from the contents of the alimentary canal, although one which bears a very small proportion to the amount injected, and not enough to account for the inflammation which is found, and which must be due also to the presence of the poison in the vessels and lymphatics of the intestinal wall.

Another point examined by Lesser is the influence of arsenic on the irritability of the striated muscular fibres and of the cerebro-spinal nerves. The method of investigation was by observing the minimum strength of the current required to excite the divided gastrocnemius in two frogs, one poisoned by arsenic, the other unpoisoned. It was found that the arsenic caused a rapid diminution in the nerve irritability, and the fall is greater during the first than during the second half of the toxic period. The effect is not confined to the nerve-trunk, for other experiments seem to show that there is a similar and still more rapid action upon the termination of the nerves in the muscles. From other experiments Lesser infers that the irritability of the muscular fibres themselves is lowered by the poison in just the same manner as that of the nerve, but he does not appear in these to have excluded with sufficient care the possible participation of the intramuscular nerve-filaments. Investigations on the influence of arsenic on the sensitive nerves, and their terminations in the spinal cord, show that immediately after the injection there is a brief increase in reflex irritability, somewhat later a diminution, and, finally, a disappearance after the arrest of the heart's action. These effects are produced by a direct action on the spinal cord, since they appear at the same time in a leg which is exposed to the action of the poison as in one which is excluded from the action by ligature of the artery.—*Lancet*, Nov. 9, 1878.

Hypnotic Action of Sodium Lactate.

W. VON BÖTTCHER (*Berliner Klin. Wochenschrift*, 1877, No. 37) states that the effects of lactic acid as an hypnotic were tried upon 60 cases. The dose of the sodium salt varied from 8 to 15 cubic centimetres. Of these 60 cases, 39 gave negative, whilst 21 gave positive results. In 7 of the 21 positive cases, the effect of the lactic acid was to give sound sleep after an hour's interval; in 9 cases the ordinary sleep became deeper, whilst in others again there was an abnormal feeling of fatigue. The action was relatively more certain in young females when administered upon an empty stomach, and in the evening. There was no period of excitation before the advent of sleep, but the after effects upon the digestion were most unpleasant. Lactic acid is, therefore, to be considered as an untrustworthy hypnotic.—*Lond. Med. Record*, Oct. 15, 1878.

Anæsthetic Properties and Mode of Elimination of Iodide of Ethyl.

M. RABUTEAU, in a note read before the Société de Biologie (*Gazette Médicale de Paris*, October 12, 1878), discusses the anæsthetic properties and mode of elimination of iodide of ethyl. This, the ordinary hydriodic ether, is a colourless liquid of a pleasant ethereal smell, with a piquant taste, which, however, is not caustic, as in the case of chloroform; its density is 1.946. It is readily soluble in alcohol, and in ether, but only very slightly so in water. Mingled with water it falls to the bottom, dissolving so far as to impart its taste and smell to the mixture. It volatilizes readily at the ordinary temperature, producing cold. It boils at 72.2° C. (161.96° Fahr.), but is not inflammable. Iodide of ethyl is rapidly altered by light, becoming brown from liberation of iodine, but it may be again made colourless by shaking it with water which has been rendered feebly alkaline, and afterwards washing with pure water. It is slowly decomposed by the alkalies, and by the oxide and salts of silver. Iodide of ethyl is therefore an unstable ether. The body is formed by the action of hydriodic acid upon ethyl-alcohol, iodide of ethyl and water being formed. Experiments with fowls, frogs, and plants show that iodide of ethyl is an anæsthetic which acts more slowly than bromide of ethyl and chloroform, that its effects are more persistent, that it is broken up in the organism into an iodide which is probably the iodide of sodium, that it is found in the saliva and urine, and that, like bromide of ethyl, chloroform, and ordinary ether, it prevents germination.—*Lond. Med. Record*, Nov. 15, 1878.

Pelletiérine.

M. DUJARDIN-BEAUMETZ, at the meeting of the Société de Thérapeutique on June 26th (*Gazette Hebdomadaire*), read a paper on the action of "pelletiérine" when used as an anthelmintic. He showed a tænia which had been expelled after the use of this new alkaloid, which was discovered by Tauret (of Troyes). The dose administered was 57 centigrammes (eight grains) of "pelletiérine" in 300 grammes of water. In about a quarter of an hour headache and faintness were experienced by the patient; after two hours he took a dose of castor oil, and in the course of the day an entire tænia was passed. Similar results